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Water Framework Directive
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Guidance on the Classification of Ecological Potential for Heavily Modified Water Bodies and Artificial Water Bodies

UKTAG Guidance

31st March 2008
Final Report

Document title	UKTAG Guidance on the Classification of Ecological Potential for Heavily Modified Water Bodies and Artificial Water Bodies
Document short title	Guidance for defining Good Ecological Potential
Status	Final Report
Date	31st March 2008
Project name	Defining Good Ecological Potential - UKTAG guidance
Contractors	Royal Haskoning Ltd

This method and guidance has been prepared by Royal Haskoning for UKTAG, representing the views and input from sectors who will be applying the guidance. Trialling of the guidance has been undertaken by the sectors lead by SEPA, Environment Agency, British Waterways, Jacobs (for Flood Risk Management) and Jan Brooke (independent consultant representing the Ports) and the outcomes from the trialling (coordinated by Royal Haskoning) have been taken into account.

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1 INTRODUCTION

1.1 Purpose of this Guidance

This document provides guidance on the process of classifying the ecological potential of Heavily Modified Water Bodies (HMWBs) and Artificial Water Bodies (AWBs). The guidance sets out a method for identifying whether a HMWB or AWB meets its ecological potential or not by:

- Identifying the impacts affecting the water body;
- Identifying the mitigation measures necessary that could be taken to improve the ecology; and
- Assessing whether those measures have been taken.

Further guidance on how the chemical and physico-chemical quality of the water body will be taken into account in the classification is included in section 3 of the guidance.

Heavily Modified (HMWBs) and Artificial Water Bodies (AWBs)

Surface water bodies are designated as heavily modified where:

(i) the bodies are not artificial water bodies;
(ii) their physical characteristics have been substantially changed in character; and
(iii) the changes to their hydromorphological characteristics necessary to achieve good surface water status would have a significant adverse impact on one or more of the water uses listed below or on the water environment.

The uses for which water bodies may be designated are:

1. navigation, including port facilities, or recreation;
2. activities associated to water storage;
3. water regulation, flood protection or land drainage; or
4. other equally important sustainable human development activities.

Artificial water bodies are bodies of surface water created by man where no water body previously existed.

1.2 What is classification?

Member States are required to aim to achieve Good Ecological Potential by 2015. The ecological potential of a water body represents the degree to which the quality of the water body's aquatic ecosystem approaches the maximum it could achieve, given the heavily modified and artificial characteristics of the water body that are necessary for the use or for the protection of the wider environment.

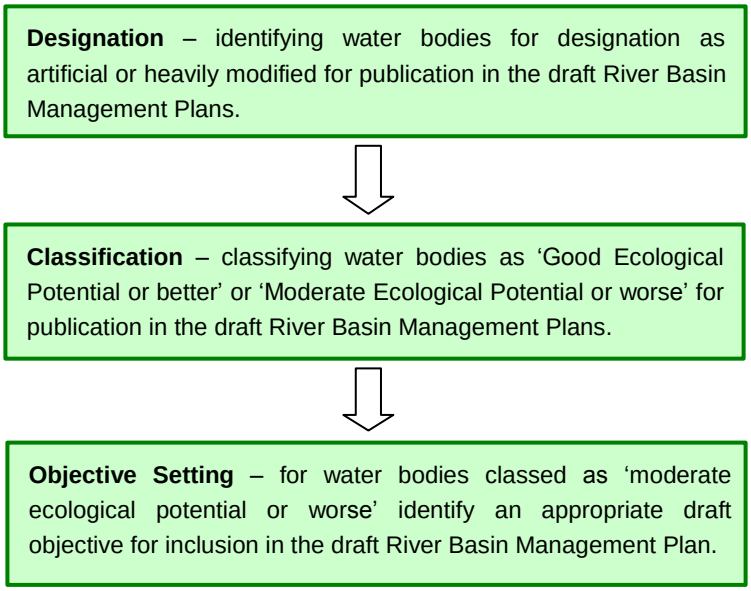
In principle, there are five ecological potential classes: Maximum, good, moderate, poor and bad. In the first cycle of the River Basin Management Planning process, classification of HMWBs and AWBs will be according to two classes: those water bodies that have met the target of Good Ecological Potential and those that have not. The method will enable water bodies to be classified as:

(i) *Good Ecological Potential or better*; or
(ii) *Moderate Ecological Potential or worse.*

This will be reported in the River Basin Management Plans and the information used to support the Objective Setting Process.

Figure 1 shows where classification fits into the process of River Basin Management Planning.

Figure 1: The role of classification in River Basin Management Planning



Objective Setting

For those water bodies which are *Moderate Ecological Potential or worse* (i.e. where improvement is required) measures which have been identified during classification will be taken forward to the Objective Setting process (options identification, appraisal and setting objectives).

Where the achievement of the objective of meeting Good Ecological Potential by 2015 (by implementing mitigation measures) would be disproportionately costly, Member States may extend the deadline for achieving Good Ecological Potential or set a less stringent objective than Good Ecological Potential. This process of Objective Setting is not covered in this guidance.

The results of the classification process will contribute to the preparation of the draft River Basin Management Plans in 2008.

1.3 Assessing the ecological potential of a water body

The method set out in this guidance is based on the use of generic checklists devised to help assess the ecological potential of water bodies designated as heavily modified or artificial. These checklists are based on an approach to be used for this first River Basin Planning cycle which uses mitigation measures that could be taken as a way of assessing whether more could be done to increase the ecological potential of the water body. This approach is known as the Alternative Approach and is defined in more detail in the Water Framework Directive Common Implementation Strategy (2006). Checklists have been developed based on the steps identified in the Alternative Approach to enable large numbers of heavily modified and artificial water bodies to be assessed consistently and across sectors.

The process of classifying ecological potential is based on an assessment of whether measures included in the checklists have been taken to mitigate the modified or artificial hydromorphological characteristics of the water body. How these mitigation measures have been defined is explained in Section 1.4.

The hydromorphological characteristics of a water body will support the achievement of *Good Ecological Potential or better* where all mitigation measures on the relevant checklists relevant to the identified impacts have been taken **excepting those** which:

(i) are not practicable given the characteristics of the water body;
(ii) have a significant adverse impact upon the use; or
(iii) have a significant adverse impact upon the wider environment.

Where all measures are in place, the water body will be defined as achieving *Good Ecological Potential or better*, and where measures are not in place then the water body will be defined as *Moderate Ecological Potential or worse*.

Key Point

The financial costs of mitigation measures are not considered in the classification process. The costs of measures are taken into account in the Objective Setting process referred to in Figure 1. If a measure is disproportionately expensive, an extended deadline or less stringent objective will be set by the competent authority for the water body or bodies concerned.

1.4 How has this Guidance been developed?

The United Kingdom Technical Advisory Group (UKTAG[1]) has initiated research projects, workshops and trials to develop lists of hydromorphological mitigation

[1] A partnership of the UK environment and conservation agencies supporting the implementation of the European Community (EC) Water Framework Directive

measures relevant to different water uses. A summary of the work undertaken to develop the method and mitigation measures to support different water uses is shown in Table 1.

Table 1: UKTAG work to support the classification process

Water use (sectors)	Activity	Description
Water storage for water supply and hydropower.	Research project.	Mitigation Measures for estimating the ecological potential of water bodies designated as heavily modified because of impounding works (UKTAG, 2007a), building upon research projects WFD29 (SNIFFER, 2007) and WFD76 (SNIFFER, 2007).
Inland Navigation.	Research project.	Management Strategies and Mitigation Measures for the Inland Navigation Sector in Relation to Ecological Potential for Inland Waterways (AINA, 2007).
Ports and Harbours.	Workshop and reporting.	Setting Good Ecological Potential and Moderate Ecological Potential targets in Navigable Water Bodies using the 'Alternative Approach' (UKTAG, 2007b).
Flood Risk Management	Research project	Good Practice Design Manual for Flood Risk Management and Land Drainage Project (Environment Agency, in preparation).
All water uses	UKTAG workshop 1 (September 2007)	Discussion of findings from all research projects identified above to deliver an agreed method for trialling.
All water uses	Method trialling	Testing practical application of the method by agencies and relevant sectors.
All water uses	UKTAG workshop 2 (November 2007)	Discussion of the proposed method with representatives from different water uses and other stakeholders in light of the trialling results.

The work has focused on developing sector based lists of mitigation measures with input from representatives from the sector and other stakeholders, organised through project steering groups and workshops. Using the outcomes from this work, a process of defining which mitigation measures could be implemented (taking account of the conditions which might prevent their application, for example, significant adverse impact on use) was developed. This process has been trialled with sector and UKTAG representatives and stakeholder workshops have also been undertaken to inform the process.

More information can be found at: http://www.wfduk.org/.

1.5 Scope of this Guidance

What the guidance covers…

This guidance has been prepared to support the process of classifying the ecological potential of a water body by checking whether there are any measures that could still be taken after the checklists have been applied. The checklist approach is tailored (through the input provided by the sector groups) to the water use or uses for which the water body has been designated. The different checklists for each sector are included in Annexes to this document. The worksheets are provided for guidance, uptake and development within each UK administration.

What the guidance does not cover…

This guidance does not identify the precise mitigation needed at a site or provide design guidance. It only serves as a starting point to identify the types of measures which have potential to deliver Good Ecological Potential and which might, therefore be considered for inclusion in the River Basin Management Plan. As stated above, where a water body is at Moderate Ecological Potential or worse, the agencies will consider whether the mitigation measures are to be implemented, taking into account the cost of the measures, during the Objective Setting process.

Key Point

The method used to classify water bodies and the checklists themselves (if the Alternative Approach continues to be used) will be reviewed and updated for each river basin planning cycle as methods and understanding improve. The reviews will take account of experience of applying the guidance, information from environmental monitoring programmes, and research projects on the impacts resulting from physical modifications, and information on the effectiveness and practicability of different mitigation measures.

2 GUIDANCE ON HYDROMORPHOLOGICAL ASSESSMENT

2.1 How is the decision making process structured?

To support the decision-making process, forms have been devised as a basis for later implementation to allow *Good Ecological Potential or better* to be identified. The forms will require completion for each water body which has been designated as a HMWB or AWB. The forms facilitate identification of:

- the pressures and impacts present at a given site;
- the mitigation measures already in place at a site and whether they adequately mitigate the identified impacts;
- mitigation measures which, if implemented, would have a significant adverse effect on the water use (for example navigation or flood risk management), or the wider environment;
- mitigation measures which would only deliver a slight ecological benefit; and
- mitigation measures which could be put in place taking into account all of the above.

Where there are multiple uses affecting a water body, then the full range of potential measures for each sector should be assessed.

The decision making process on whether potential measures have already been taken is based on a step-wise process which is contained in a single form. The step-wise process is described in Figure 2 and an example form provided as Figure 3.

Figure 2: Hydromorphological Assessment Process

Defining Pressures and Impacts (Columns A and B)

Each water use sector identifies the:

- Hydromorphological modifications or artificial characteristics (pressures) associated with the water use or uses concerned, and
- The adverse ecological effects (impacts) which are or may be associated with the modification or artificial characteristic occurring in the water body in question.

Mitigation measures are associated to the impacts in the checklists and are assessed against the questions in the next step.

⇩

Identifying the mitigation measures applicable to the water body (Column C-F)

A series of checkboxes are set out in Columns C to F to test whether each mitigation measure for the identified impact(s) is in place and, where it is not in place, test the applicability of each listed measure.

⇩

Classifying the ecological potential of a water body (Column G)

Where all applicable mitigation measures on the checklist have already been taken or screened out, the water body is classified as *Good Ecological Potential or better*. Where one or more applicable mitigation measure(s) remain to be taken, the water body is classified as *Moderate Ecological Potential or worse*. This will then be combined with the outcomes from other assessments to give an overall classification. An assessment of confidence will be made based on the level of uncertainty associated with the decision.

⇩

Assessing remaining measures (Column H and I)

Where mitigation measures remain to be taken, they can be screened to check whether they would only contribute towards Maximum Ecological Potential (only deliver slight ecological benefit) or are likely to require alternative objectives as a result of disproportionate cost or technical infeasibility. These columns do not affect the classification but will feed into the Objective Setting process.

2.2 Overview of the process

Figure 3 shows a short version of responses to the questions using example mitigation measures (full guidance is for each sector in Sections 2.3 to 2.15 and the Annexes).

The process is structured to work logically from left to right, answering the question at the head of each column. For each identified impact, the associated mitigation measures on the checklist are considered to be potentially applicable unless a column is reached where the measure is screened out and does not therefore need to be put in place for the water body to be classified as *Good Ecological Potential or better*.

Wherever a measure is screened out in this way, an appropriate explanation/justification is required. This ensures a transparent process and provides a clear audit trail of the decision making process. If the answer is clear cut (e.g. removing a currently operational structure unsafe and therefore not practicable) then the explanation may be brief. However, where the reason behind a screened out measure is more complicated, a fuller justification may be necessary. Once a measure has been screened out, it does not need to be considered any further. Where there is uncertainty about the answer, a response should be given with a question mark indicating uncertainty, e.g. Yes (?) or No (?).

Column G summarises the outcomes from the questions in Columns C-F. For measures that remain to be taken, a cross will be marked in Column G (e.g. they are not in place). Where one or more crosses remain, the water body will not be at *Good Ecological Potential or better* (i.e. it will be at *Moderate Ecological Potential or worse*).

It is important to remember that other pressures, apart from hydromorphology, may also be acting which do not allow the water body to reach Good Ecological Potential, even if all measures are in place to deal with physical modification. Further guidance on classification according to final version.

Figure 3: Short form showing example measures from different sectors

	A		B			C	D	E	F	G	H	I
Example Pressure (physical modification or ongoing activity)	Is the pressure present? (Y/N) If Yes, proceed to column B	Example Potential Impacts	Is there a significant adverse impact? (In the absence of any mitigation already in place would there be a significant adverse impact?) (Y/N) If Yes, proceed to column C, if no document		**Example Mitigation Measures**	Is the measure practical given the site specific considerations ? If Yes, proceed to column D, if no document	Is the mitigation measure in place and adequate? (Yes/No). If No, proceed to Column E. If Yes, document the mitigation measure and proceed to Column G	Can the measure be implemented without having a significant adverse impact on use? If Yes, proceed to column F, if no document	Can the measure be implemented without having a significant adverse impact on the wider environment? If Yes, proceed to column G, if No document	Document: x : For measures not in place (proceed to Column H) ϑ: For those already in place and adequate - : For those screened out	Will the mitigation measure provide more than a slight ecological benefit when considered in combination with other measures?	Document any reasons which could affect the inclusion of the measure in the RBMP (e.g. prioritisation in combination with other measures, disproportionate cost, other reasons why an extended deadline or less stringent target might be justified)
[FRM TRaC] Bank reinforcement		Coastal squeeze; Disruption of tidal flow and channel interaction		**1**	Removal of hard engineering structures (e.g. naturalisation)	Yes	No	No – structure is required to maintain the integrity of current flood defence infrastructure		-		
[Ports and Harbours] Structure		Interruption of sediment transport due to a breakwater		**2**	Sediment management (e.g. Trickle recharge, sediment bypass)	Yes	Yes – sediment bypass already required under current consents.			-		
[Rivers] Dams, sluices and weirs		Loss of biological continuity		**3**	Install fish pass	Yes	No	Yes	Yes	x	Yes	Costs may be disproportionate

2.3 Implementation

It is anticipated that the classification process will involve competent authorities and the operator, potentially with the involvement of relevant local experts. There may be some decisions where the outcome is uncertain (identified by a 'Yes (?)' or 'No (?)' response). This could be either because the operator and agency disagree or because of a lack of information or understanding. The guidance allows decisions where the outcome is uncertain to be documented using a question mark with the measure being retained until the end of the process. This ensures that the process can progress rapidly. Once all water bodies affected by the operator have been completed, a review of the uncertain outputs will be undertaken (see Section 2.14).

2.4 Water body information

Space is provided at the top of the form to identify the location of the water body by providing the water body ID, and eastings and northings. This information should be provided by the competent authority.

Figure 4: Water body information requirements

Waterbody Name			Easting	Northing
Waterbody ID		Downstream NGR Waterbody		
Waterbody Type		Upstream NGR Waterbody		

2.5 Checking the reasons for designation

The uses dependent on the heavily modified or artificial characteristics of the water body should have been identified in the designation process. The uses determine which checklists of measures are applicable and which sectors and competent authority experts need to be involved in the classification. This is an important check at the outset as it determines which sectors need to be involved in the classification process to deal with pressures caused by the particular use, for example, flood risk management or impoundments for hydropower.

As described in Section 2.2 other pressures may still need to be assessed as part of developing the Programme of Measures.

Key documents to help understand the designation process include:

- UKTAG An overview of classification schemes in River Basin Planning
- UKTAG Recommendations on Surface Water Status Classification (December 07)
- UKTAG Criteria and Guidance Principles for the designation of heavily modified water bodies

2.6 Identifying pressures (physical modifications) (Column A)

Is the pressure present?

Physical modifications to the hydromorphological characteristics of the water body and the artificial hydromorphological characteristics of AWBs should be identified here. Physical modifications may include, for example, re-engineering of the bed, banks or shore zone of the water body as a result of realignment, reinforcement, dredging or impoundment.

The checklists include mitigation measures which are relevant to the types of physical modification or artificial characteristics normally associated with the different water uses.

This does not mean that all these types of modification of physical or artificial characteristics will be present at every site. Where they are not present, the form should be filled in with 'No'.

If it is the case that physical modifications associated to a use appear to be extensive (with potential to cause significant ecological impact), but the water body has not been designated for that use, this should be noted in the top right hand box of the form (see Figure 5). This will trigger a review of the designation for that water body. Mitigation measures should only be considered for the use for which the water body has been designated.

Figure 5: Water Body Designation Comments Box

List the pressures identified within the HMWB/AWB designation for this water body	
Record any other uses/pressures that are present but not identified within the HMWB/AWB designation	

2.7 Assessing significant adverse ecological impact (Column B)

Is there a significant adverse ecological impact or, in the absence of any mitigation already in place, could there be a significant adverse impact?

The purpose of Column B is to identify significant adverse ecological impacts (as a result of hydromorphological alterations) that exist or could be expected to occur in the absence of mitigation. It may be that all the identified impacts are being adequately mitigated but this will be recorded separately in Column D.

The physical modifications and artificial characteristics identified in Column A may be expected to cause significant adverse ecological impact (the modifications are such that the hydromorphological characteristics cannot support the achievement of Good Ecological Status in the water body).

However in some water bodies, the type and extent of the modifications and/or the natural characteristics of the water body may mean the modified hydromorphological characteristics are not having a significant impact on the ecology.

This may be the case when:

(i) the footprint of the impact in the context of the water body scale or functioning is too small to affect the ecological potential; or
(ii) the natural circumstances (e.g. natural barriers to fish migration or lack of natural habitat) mean the biological quality elements that would normally be expected to be affected by the modification are absent (or expected to be significantly less sensitive to the modifications than would normally be the case); or
(iii) where the physical modification has resulted in a hydromorphological change which has been shown to have positive benefits on the ecology within this water body.

In relation to point (i), certain pressures, when considered in isolation may only result in a small adverse impact. However, if the pressure occurs frequently within the water body, the overall impact may be large; for example, if a river contains a number of weirs, there could be an impact at a water body scale.

Point (ii) does not apply if, for example, a biological quality element is absent because of human activities, rather than natural circumstances, elsewhere in the river basin (e.g. dams on other water bodies).

Where there is uncertainty as to whether the circumstances in points (i) to (iii) apply, the mitigation measure should **not** be screened out but the uncertainty indicated by a 'Yes (?)'.

This guidance does not consider where the ecology could be adversely altered in other 'receiving' water bodies (e.g. upstream or downstream) as a result of hydromorphological pressures in the water body in question. The need for mitigation of impacts on another water body will be identified by the classification process for that water body.

2.8 Are measures practicable? (Column C)

Is the measure practicable given the characteristics of the water body?

It is important to take into account the water body characteristics when considering whether a measure is practicable, e.g. that it is technically feasible and the measure is able to achieve improvements in ecology associated with the impacts identified in the water body in question.

Certain measures will only be effective at delivering ecological improvement in water bodies with particular characteristics, for example, some measures can deliver improvements in navigable rivers, not in canals (e.g. due to differences in flow characteristics, or canals not having a natural floodplain to which the channel can be reconnected). Particular issues relating to the practicability of measures are documented in the Annexes. Column C provides an opportunity to screen out measures which will not be effective at delivering ecological improvement given the particular water body characteristics.

2.9 Are measures already in place and adequate? (Column D)

Is the mitigation measure in place and adequate?

If there is evidence that a mitigation measure is in place and is adequate, 'Yes' should be entered in Column D and the measure documented. A tick should be placed in Column G showing that the measure is already in place. The measure need not be considered further.

If the measure is not in place or if it is considered inadequate, 'No' should be answered and the user should proceed to the next column.

The following questions may help in concluding that the mitigation measure is in place and adequate:

- Does the measure that is in place appear to be operating as it was designed to operate (e.g. there is no evidence to suggest it is defective or obsolete)?
- Is best/good practice guidance being followed?
- Has the measure has been implemented in all locations where practicable?
- Would taking further measures to mitigate deliver any more than a slight ecological benefit?

Where a measure is already 'in place and adequate', this and the delivery mechanism should be documented, for example, the measure is implemented as a condition of consent; through best practice; as a result of a management agreement.

Where there is uncertainty about whether the measure can be deemed to be in place or not, a question mark should also be placed in the Column.

2.10 Does the measure have a significant adverse impact on use? (Column E)

Can the measure be implemented without having a significant adverse impact on use?

"Use" can be defined as 'the service provided by, or yield, of the facility', e.g. to produce a certain energy yield (hydropower); to protect a certain number of houses from flooding, to allow vessels of a certain size to navigate etc. To consider whether the measure has a significant adverse effect on use, the extent to which the measure reduces the yield or impairs the service should be assessed. This needs to take into account the continued viability of maintaining the use it was designated for and any health and safety implications. For example, it may be possible to protect the same number of houses with

a different type or location of flood defence. It should be noted that the costs of mitigation measures should not be taken into account at this stage.

Where a use delivers an environmental benefit, this should also be taken account of at this stage. For example, hydropower produces energy and there are also important environmental benefits in producing energy without generating carbon dioxide. In this case reducing energy generation will also produce an adverse environmental impact. Another example is where waterborne transport may be reduced increasing road or air transport which adverse environmental impacts (such as air quality and noise impacts). As the impacts are so closely related to the 'the service provided' it should be recorded at this stage rather than under Column F, 2.11.

Where there is uncertainty about the decision resulting from disagreement, the measure should be retained with uncertainty recorded using a 'Yes' (?).

2.11 Can the measure be taken without a significant adverse impact on the wider environment? (Column F)

Can the measure be implemented without having a significant adverse impact on the wider environment?

For the purposes of this guidance the 'wider environment' refers to designated sites (including, those for nature conservation and landscape designations), Scheduled Monuments and listed structures. In addition, significant local factors which would be likely to cause implementation of the measure being stopped at a later date should be identified. This could include any environmental factor/interest for example, biodiversity, landscape, built heritage. It does not include any adverse impacts on environmental interests resulting from the impacts on the service provided by the use (e.g. the renewable energy provided by a hydropower scheme). Such impacts should be recorded under Column E (Section 2.10).

Key environmental constraints on applying mitigation measures should be identified through this classification process. It is assumed that the measures would be implemented and/or managed according to best practice to limit environmental impact. Detailed assessments will not be possible at this stage and uncertainties should be reflected in the answer given using a 'Yes (?)' response. Where necessary further assessments will be undertaken during Objective Setting stage.

2.12 Documenting measures for classification (Column G)

Document:

8 For measures **not** in place or inadequate
9 For those measures in place and adequate
- For those screened out

At this stage in the process, the measures can be checked to assess whether the water body will be classified as:

- *Good Ecological Potential or better* – where all measures have been either screened out (-) or recorded as in place or adequate (9).
- *Moderate Ecological Potential or worse* – where measures remain to be taken (8)

Where there is one or more cross(es), the water body is classified *Moderate Ecological Potential or worse*, as measures could still be taken to achieve *Good Ecological Potential or better*. Examples of classifications according to the above systems are shown below.

Mitigation Measures	Example Column G	Example Column G	Example Column G	Example Column G
Example 1	-	9	9	9
Example 1	-	9	9	8
Example 1	-	-	8	-
Classification	**Good Ecological Potential or better**	**Good Ecological Potential or better**	**Moderate Ecological Potential or worse**	**Moderate Ecological Potential or worse**

2.13 Measures which only have a slight ecological benefit (Column H)

Will the mitigation measure provide more than a slight ecological benefit when considered alone or in combination with other measures?

When the characteristics of a particular water body are considered, some measures only have a limited beneficial effect i.e. they would not contribute to realising Good Ecological Potential but if taken could result in or contribute to the Maximum Ecological Potential being achieved using the Alternative Approach. This could either be because of the site-specific physical characteristics of the water body or when taken in combination, the relative benefit of a specific measure will be reduced (another measure be selected as it is more cost effective and this would rule out the benefit of taking the measure in question).

All measures identified through this classification process will be taken forward to the Objective Setting process. This question is to identify, at a high level, measures which only deliver slight benefit in the water body under consideration or obvious examples of where more than one measure could be taken but it is not necessary to take both. For example, it could be possible to take out a structure on a water course to improve flows downstream; it could also be possible to re-engineer (narrow) the channel to deal with the present flow regime. There may be no benefit in doing both measures and hence consideration is needed of which to apply most effectively.

It may also be the case that in some situations, the benefits of a particular measure would be different if it were applied together with another measure (possibly from another sector). In this case the balance of sector uses also needs to be considered.

2.14 Additional comments for implementation (Column I)

Column I

Document any significant uncertainties and/or any reasons which could affect the inclusion of the measure in the RBMP (e.g. prioritisation in combination with other measures, disproportionate cost, other reasons why an extended deadline or less stringent target might be justified)

This is the opportunity to document key information about the measure which is likely to be useful in subsequent Objective Setting or implementation stages. It is likely that some matters of detail for the particular approach to the measure (e.g. costs, sources of information) emerge through the classification process. This column provides a means of quickly capturing the key points or references to feed into the appraisal and implementation and further assessment work.

2.15 Reviewing the output

Once all water bodies affected by the operator have been completed then it is suggested that the uncertain decisions indicated by 'Yes (?)' are revisited. The experience of applying the decision making across all water bodies may make the decision making easier to resolve. However, ultimately the decision is the responsibility of the competent authority. It is suggested that where disagreement remains the classification result is recorded as of low/medium confidence in Column I. Those measures of low/medium confidence will not be considered for Programme of Measures during the first cycle of River Basin Management Planning.

3 CLASSIFICATION AND WATER QUALITY IMPACTS IN ARTIFICIAL AND HEAVILY MODIFIED WATER BODIES

Heavily modified and artificial water bodies that are polluted cannot be classed as good or maximum ecological potential. This section sets out the UKTAG's recommendations on how water quality related impacts should be taken into account in classification.

3.1 Chemical and physicochemical quality elements

The UKTAG has identified environmental standards for a series of general chemical and physicochemical quality elements and for specific pollutants[2]. The UKTAG recommends that these standards are used in classifying the ecological potential of heavily modified and artificial water bodies in the same way that they are used for classifying ecological status[3].

In limited circumstances, the application of standards for particular general chemical and physicochemical quality elements may not be appropriate. If, in the absence of pollution, the values for a chemical or physicochemical element depend strongly on hydromorphological characteristics, the UKTAG recommends that the applicability of the environmental standard for that quality element is reviewed before using it to classify.

If the hydromorphological characteristics of the water body at good ecological potential of differ substantially from the hydromorphological characteristics of the water bodies that were taken into account in deriving the standard, that standard is unlikely to be applicable. The most likely cases where this might happen is the standard for dissolved oxygen.

For example, suppose a river has been so heavily modified that its flow-characteristics for good ecological potential are very sluggish and the water is stagnant. The UKTAG environmental standards for dissolved oxygen are unlikely to apply to such a water body.

3.2 Biological quality elements

The UKTAG has developed a range of biological tools for assessing the ecological status of water bodies.

The UKTAG recommends that only tools that are little affected by hydromorphological alterations are used to assess pollution of heavily modified and artificial water bodies. If the results from such tools indicate "moderate status", the water body would be classed as moderate ecological potential.

In most circumstances, it is expected to be appropriate to use the following tools in this way:

(i) phytoplankton;
(ii) phytobenthos
(iii) lake invertebrates.

[2] http://www.wfduk.org/UK_Environmental_Standards/
[3] http://www.wfduk.org/tag_guidance/Article%20_11/POMEnvStds/sw_class/view

Other biological tools are more likely to respond to the ecological affects of hydromorphological alterations. This means that applying the tools to unpolluted heavily modified or artificial water bodies could result in a classification of "moderate", "poor" or "bad" even though the hydromorphological characteristics of the water body are consistent with good ecological potential. For this reason, the UKTAG recommends that the following tools are not used for classification unless they are known to be ecologically insensitive to the artificial or heavily modified characteristics of the water body concerned:

(i) macrophytes; and
(ii) fish.

3.3 Effectiveness monitoring

The UKTAG recommends that the hydromorphological characteristics of artificial and heavily modified water bodies at risk of failing to achieve good ecological potential are monitored to identify changes to those characteristics delivered by the implementation of mitigation measures. The UKTAG recommends that such monitoring takes the form 'before' and 'after' monitoring and is only undertaken where mitigation measures are to be implemented.

UKTAG also recommends that the biological quality of artificial and heavily modified water bodies be monitored to identify biological changes delivered by the implementation of mitigation measures. UKTAG recommends that such monitoring is undertaken using those biological tools sensitive to the relevant hydromorphological changes; takes the form of 'before' and 'after' monitoring; and is only undertaken where mitigation measures are to be implemented.

At present, biological tools do not have the necessary sensitivity to hydromorphological change to fully evaluate the effectiveness of mitigation measures. UKTAG expects the sensitivity of biological monitoring tools to hydromorphological alterations to improve over time as a result of on-going research and development. Such improvements will, in turn, improve the agencies' abilities to assess the ecological effects of mitigation measures.

UKTAG recommends that the results of the effectiveness monitoring, in so far as they are available, be used to refine and develop the checklist of mitigation measures during the preparation of the first updates of the river basin management plans.

3.4 Future refinement of classification

The UKTAG recommends that when suitably sensitive biological tools are available, groups of water bodies with similar heavily modified or artificial characteristics are monitored. The results would be used to:

(i) refine the procedure (e.g. enabling it to differentiate waters classed as 'moderate ecological potential or worse' into 'moderate', 'poor' and 'bad'; and refine the checklists of mitigation measures); and

(ii) where possible and practicable, develop and calibrate biological tools for assessing water bodies sharing similar heavily modified or artificial characteristics and uses.

The UKTAG recommends that the results of the assessments outlined in (i) and (ii) above, are applied in the preparation of each update of the river basin management plans.

4 REFERENCES

Association of Inland Navigation Authorities (2007) Management Strategies and Mitigation Measures for the Inland Navigation Sector in Relation to Ecological Potential for Inland Waterways.

Environment Agency (in preparation) Digital Good Practice Manual to determine environmental Mitigation Measures for Flood Risk Management and Land Drainage Activities.

SNIFFER (2004) WFD 29 Management strategies and mitigation measures required to deliver the Water Framework Directive for impoundments

SNIFFER (2007) WFD 76 Management strategies and mitigation measures required to deliver the Water Framework Directive for flood defence impoundments, navigation impoundments and small scale weirs

SNIFFER (2007) WFD82 Guidance on Environmental Flow Releases from Impoundments to Implement the Water Framework Directive

UKTAG (2007a) Classification of Good Ecological Potential in water bodies designated as Heavily Modified Water Bodies because of impounding works. (Draft, Version 14).

UKTAG (2007b) Setting Good Ecological Potential and Moderate Ecological Potential targets in Navigable Water Bodies using the 'Alternative Approach': Findings from the workshop.

Water Framework Directive Common Implementation Strategy (2006) WFD and Hydromorphological Pressures Technical Report: Good Practice in Managing the Ecological Impacts of Hydropower Schemes, Flood Protection Works and Works Designed to Facilitate Navigation under the Water Framework Directive.

Annex I Ports and Harbours

How should this Annex be used?

The purpose of this Annex is to provide specific guidance on using the checklist of mitigation measures for water bodies designated as heavily modified as a result of Ports and Harbours. Guidance is provided where specific guiding principles have been identified by the sector to help the decision making process. Where specific guidance has not been identified the user should refer to the generic guidance.

It is anticipated that this Annex will be updated and improved in subsequent River Basin Management Planning cycles. This Annex should be used in conjunction with the spreadsheet entitled 'Ports and Harbours'.

How is the Annex Guidance Structured?

The Annex Guidance is structured in the same way as the main document with guidance under each column (A-F).

For comments relating to Columns C-F, reference to both the column heading (C-F) followed by the mitigation measure number is made, (specific to water body type) for example, for a guidance on Ports and Harbours under Column C for mitigation 5, this would be referenced in square brackets [C.5].

Within the Ports and Harbours spreadsheet a number of generic measures could be applied to more than one pressure. For example, Measure 7 (Indirect or offsite mitigation) is relevant to both 'maintenance dredging' and 'dredged material disposal' pressures. Where a measure has been repeated this has been shown in italics in the measures spreadsheet. It may not be necessary to repeat the decision making for this measure if both pressures apply. However, it may still be helpful to go through the decision making separately if there are likely to be differences in how the measure is to be applied.

Useful references

If an expert group is to be used, in order to maximise its effectiveness, it is suggested the representatives attending the meeting should be asked to bring with them the following:

- Relevant Admiralty Chart for water body/adjacent water bodies;
- Information on locations/quantities of dredging, disposal sites, etc; and
- Information on any existing mitigation measures and the impacts they are intended to mitigate.

Where appropriate, representatives of the recreational boating sector should also be invited to attend.

ANNEX I: PORTS AND HARBOURS

Sector: **Ports and Harbours**

Waterbody Information:

Waterbody Name			Easting	Northing
Waterbody ID		NGR Waterbody		
Waterbody Type		NGR Waterbody		

List the pressures identifed within the HMWB/AWB designation for this waterbody	
Record other water uses appearing to cause signficant pressure not identified within the HMWB/AWB designation	

	A		B			C	D	E	F	G	H	I
Pressure (physical modification)	**Is the pressure present? (Y/N) If Yes, proceed to column B.**	**Potential Impacts**	**Is there a significant adverse ecological impact or, in the absence of any mitigation already in place, could there be a significant adverse impact? (Y/N) If yes, proceed to column C, if no document and proceed to Column G.**	**Mitigation Measures**	**No.**	**Is the measure practicable given the characteristics of the water body? (Yes/No) If yes, proceed to Column D. If no, document and proceed to column G.**	**Is the mitigation measure in place and adequate? (Yes/No) If No, proceed to Column E. If Yes document the mitigation measure and proceed to Column G.**	**Can the measure be implemented without having a significant adverse impact on use? (Yes/No) If yes, proceed to column F, if no document and proceed to Column G.**	**Can the measure be implemented without having a significant adverse impact on the wider environment? (Yes/No) If yes, proceed to Column G, If no document and proceed to Column G.**	**Document: x : For measures not in place (proceed to Column H) 9: For those already in place and adequate - : For those screened out**	**Are there any reasons that could affect the inclusion of the measure in the RBMP, or where an extended deadline or less stringent target might be justified?**	**Document reasons for answers to questions B, C, D, E and F**
Maintenance Dredging		Physical disturbance due to removal of sediment or re-deposition of disturbed sediment; Increased suspended sediment in water column; change in flows; change in wave propagation; change in sediment transport; direct or indirect habitat loss or change; reduced water quality.		Avoid the need to dredge (e.g. Minimise under-keel clearance; fluid mud navigation; flow manipulation or training works)	**1**							
				Prepare a disposal strategy (e.g. Consider frequency and quantity of dredging; phasing; forward planning)	**2**							
				Reduce impact of dredging (e.g. Dredge smaller area, shallower depth; dredger type)	**3**							
				Reduce sediment resuspension (e.g. Minimise bucket release; use visor; silt curtains; manage overspill)	**4**							
				Alter timing of disposal (e.g. Seasonal or tidal restrictions)	**5**							
				Sediment management (e.g. Trickle recharge, sediment bypass; water column recharge; beneficial placement)	**6**							
Dredged material disposal		Smothering due to deposition of sediment; disturbance due to deposition of resuspended sediment; increased suspended sediment in water column; direct habitat loss or change due to disposal.		Site selection (e.g. Avoid sensitive sites)	**7**							
				Manage disturbance (e.g. Confine disturbance; dispose over wider area; disposal method or rate)	**8**							
				Prepare a disposal strategy (e.g. Consider frequency and quantity of dredging; phasing; forward planning)	***2***							
				Alter timing of disposal (e.g. Seasonal or tidal restrictions)	***5***							
Vessel Movement		Physical disturbance of sea bed habitats; ship wash (leading to erosion); indirect impacts and habitats.		Modify channel (e.g. Deepen; realign channel)	**9**							
				Modify vessel design (e.g. Shallower draft)	**10**							
				Vessel Management (e.g. Traffic management; speed limits)	**11**							
Existing modifications, including structures, reclamation and capital dredging		Change in flows; changes in sediment transport; change in wave energy or direction; change in water quality resulting from changes in flows; direct or indirect habitat loss; disruption of habitat continuity or connectivity.		Remove obsolete structure	**12**							
				Modify structure or reclamation (e.g. Construct culverts in breakwaters; reduce wave reflection; increase wave absorption; replace with environmentally friendly materials or design; compensatory dredging, managed realignment)	**13**							
				Flow manipulation (e.g. Construct structures to normalise flow; realign frontage)	**14**							
				Sediment management (e.g. Trickle recharge, sediment bypass; water column recharge; beneficial placement)	***6***							

*Italics denote measures that are applicable to more than one impact.It may not be necessary to re-assess the measure, please see Guidance.

Hydromorphological assessment for classification	

Identifying pressures (Column A)

Please see General Guidance.

Identifying where there is no significant adverse ecological impact (Column B)

The impacts identified within the spreadsheet are related to those hydromorphological quality elements listed within the Water Framework Directive itself (Annex V). In order to determine whether an impact is significant within specific water bodies, it may help to refer back to those quality elements. These are as follows:

- Morphological conditions
- Depth variation
- Quantity, structure and substrate of the bed
- Structure of the inter-tidal zone
- Tidal regime
    - Freshwater flow
    - Direction of dominant currents
    - Wave exposure

The hydromorphological quality elements listed above are considered to (in part) support the biological quality elements of the Water Framework Directive. For reference the biological quality elements are as follows:

- Composition, abundance and biomass of phytoplankton
- Composition and abundance of other aquatic flora
    - Macroalgae
    - Angiosperms
- Composition and abundance of benthic invertebrate fauna
- Composition and abundance of fish fauna

Measures which may not be practicable given site specific characteristics (Column C)

In certain instances some impact(s) may not be present and therefore a particular mitigation measure associated to an impact which is not present may not be necessary. Where this is the case, this should be documented in Column C and the measure screened out, and then marked as such in Column G.

[C.4] reducing sediment resuspension during dredging is not a relevant measure if the problem is the loss of intertidal habitat.

[C.6] sediment management measures (i.e. what is done with the sediment once dredged) are not relevant if the impact of concern relates to the levels of disturbance during maintenance dredging.

Assessing whether the measure is in place and adequate (Column D)

Where a measure is already 'in place and adequate', this should be documented and the delivery mechanism for the measure should be explained. Examples might include:

- Measure is a requirement of a licence or consent (e.g. FEPA, river works licence).
- Measure is delivered via enforced bylaws, etc.
- Measure is delivered via a monitored and reviewed agreement.
- Measure is already delivered via established good/best practice.

The dredging strategy being used by the Port of London is an example of where the measure is in place, can have wider stakeholder input and is adequate. The measure is already delivered by good/best practice.

Where significant adverse impact on use might apply (Column E)

'Use' can be defined in terms of the numbers and types of vessels able to navigate in the water body/to access port facilities. Thus, for ports and navigable maritime water bodies, an adverse effect on use might be demonstrated if there are some or all of the following:

- Issues affecting the viability of use (e.g. shallower channel means that larger vessels can no longer access the port; speed limit on 'fast commuter service')
- Safety implications (e.g. underkeel clearance too low; vessel manoeuvrability if speed too low)
- Issues of practicality (e.g. need to close port to implement measure; stationary operation in busy channel)

Where there may be a significant adverse impact on the wider environment (Column F)

Mitigation measures that may adversely affect the wider environment should be screened out, for example measures that would, for example, cause damage to (protected) freshwater sites behind the defences or lead to the loss of a high tide roost.

Another port-specific example is the situation at Harwich where water column recharge needs to take place to meet the requirements of the Habitats Regulations (by ensuring that sediment is retained within the estuarine system): measures to limit sediment re-suspension would thus have a detrimental effect on a protected site.

Annex II Impoundments for Water Storage and Supply

How should this Annex be used?

The purpose of this Annex is to provide specific guidance on using the checklist of mitigation measures for water bodies designated as heavily modified as a result of Impoundments for Water Storage and Supply. Guidance is provided where specific guiding principles have been identified by the sector to help the decision making process.

Where specific guidance has not been identified the user should refer to the generic guidance.

It is anticipated that this Annex will be updated and improved in subsequent river basin management planning cycles.

This Annex should be used in conjunction with the spreadsheet entitled 'Impoundments for Water Storage and Supply'. The spreadsheet should be used for HMWB's and AWB's. Many of the potential impacts and mitigation measures will not apply to AWB's.

How is the Annex Guidance Structured?

The Annex Guidance is structured in the same way as the main document with guidance provided under each column where necessary.

For comments relating to Columns C-F reference to both the column heading (C-F) followed by the mitigation measure number is made, (specific to water body type) for example, for guidance under Column C for mitigation 5, this would be referenced in square brackets [C.5].

ANNEX II: IMPOUNDMENTS FOR WATER STORAGE AND SUPPLY

Sector: **Impoundments for Water Storage and Supply**

Waterbody Information:

Waterbody Name			Easting	Northing
Waterbody ID		Downstream NGR Waterbody		
Waterbody Type		Upstream NGR Waterbody		

List the pressures identifed within the HMWB/AWB designation for this waterbody	
Record other water uses appearing to cause signficant pressure not identified within the HMWB/AWB designation	

	A		B			C	D	E	F	G	H	I
Pressure (physical modification)	**Is the pressure present? (Y/N) If Yes, proceed to column B.**	**Potential Impacts**	**Is there a significant adverse ecological impact or, in the absence of any mitigation already in place, could there be a significant adverse impact? (Y/N) If yes, proceed to column C, if no document and proceed to Column G.**	**Mitigation Measures**	**No.**	**Is the measure practicable given the characteristics of the water body? (Yes/No) If yes, proceed to Column D. If no, document and proceed to column G.**	**Is the mitigation measure in place and adequate? (Yes/No) If No, proceed to Column E. If Yes document the mitigation measure and proceed to Column G.**	**Can the measure be implemented without having a significant adverse impact on use? (Yes/No) If yes, proceed to column F, if no document and proceed to Column G.**	**Can the measure be implemented without having a significant adverse impact on the wider environment? (Yes/No) If yes, proceed to Column G, If no document and proceed to Column G.**	**Document: x : For measures not in place (proceed to Column H)** **9: For those already in place and adequate** **- : For those screened out**	**Will the mitigation measure provide more than a slight ecological benefit when considered alone or in combination with other measures? If yes, proceed to Column I; if no, document**	**Document any reasons which could affect the inclusion of the measure in the RBMP (e.g. prioritisation in combination with other measures, disproportionate cost, other reasons why an extended deadline or less stringent target might be justified)**
Impoundment		Adverse impact on the movement of salmon and sea trout between habitats important in their life cycles.		Structures or other mechanisms in place and managed to enable fish to access waters upstream and downstream of the impounding works.	**1**							
				Where structures or other mechanisms are in place to enable fish to access waters upstream of the impounding works, the volume and timing of flow releases is sufficient to enable and, where relevant, trigger fish migration.	**2**							
				Management of the risk of fish entrainment in turbines or intakes to enable downstream fish passage.	**3**							
				Enable access to relevant feeder-streams draining into the reservoir at appropriate times for spawning and migration.	**4**							
		Adverse impacts on the downstream river flows necessary to maintain river habitats and their associated aquatic plants or animals		Establish an appropriate baseline flow regime.	**5**							
				Re-engineering of the river where the flow regime cannot be modified.	**6**							
		Adverse impacts on the morphological characteristics of the downstream river		Maintain sediment management regime to avoid degradation of the natural habitat characteristics of the downstream river.	**7**							
				Provide flows to move sediment downstream (freshets and/ or spills).	**8**							
		Adverse impacts on the water quality of the downstream river		Ensure that good status of dissolved oxygen levels is being achieved downstream of the impounding works	**9**							
				Ensure that the thermal regime in waters downstream of the impounding works is consistent with good status conditions.	**10**							
		Adverse impacts on the level regime necessary to maintain lake/loch habitats and their associated aquatic plants and animals in the impounded water body		Ensure the rate and range of any artificial drawdown is appropriately managed to maintain aquatic plant and animal communities in the shore zones of impoundments with gently shelving shore zones.	**11**							
				Ensure the seasonal pattern of water levels during each year is managed so as to enable the establishment and retention of aquatic plant and animal communities in the shore zone of the impoundment.	**12**							

Hydromorphological assessment for classification	

Identifying pressures (Column A)

Please gee Generic Guidance.

Identifying where there is no significant adverse ecological impact (Column B)

The impacts identified within the spreadsheet are related to those hydromorphological quality elements listed within the Water Framework Directive itself (Annex V). In order to determine whether an impact is significant within specific water bodies, it may help to refer back to those quality elements. These are as follows:

- Hydrological regime
  - Quantity and dynamics of water flow
  - Connection to ground water bodies
  - Residence time
- River continuity
- Morphological conditions
  - Depth and width variations
  - Structure and substrate of the bed
  - Structure of the riparian zone or lake shore.

The hydromorphological quality elements listed above are considered to (in part) support the biological quality elements of the Water Framework Directive. For reference the biological quality elements are as follows:

- Composition and abundance of aquatic flora
  - Phytoplankton
  - Macrophytes and phytobenthos
- Composition and abundance of benthic invertebrate fauna
- Composition, abundance and age structure of fish fauna

The following provide descriptions of where it may be concluded there is no significant adverse ecological impact. Only those measures where it is possible that there may not be a significant adverse ecological impact have been referenced. For all others it is assumed that the pressure will result in a significant adverse ecological impact.

Please also refer to:

- UKTAG (revised November 2007) UK Environmental Standards and Conditions (Phase 1) Final Report
- UKTAG (2007) Recommendations on Surface Water Classification Schemes for the Purposes of the Water Framework Directive

Significant adverse impact on the movement of one or more species of salmonid fish between habitats important in their lifecycles

[B.1 – B.4]

Waters upstream of the impounding works may:

(i) be unsuitable for fish due to their natural characteristics (e.g. steepness; substrate; etc);
(ii) be naturally inaccessible to migratory fish (e.g. because of impassable waterfalls; etc); or
(iii) contain such a limited extent of fish habitat that access to it would not contribute to improving ecological potential.

If point (i), (ii) or (iii) applies, mitigation measures B.1, B2, B3 and B.4 may be unnecessary.

[B.2] The need to mitigate changes to flows in the downstream river may depend on whether flows from tributaries entering the river below, but close to, the dam are of sufficient magnitude to enable and trigger migration (even if mitigation were in place).

If suitable flows are present, the mitigation measure can be screened out.

[B.4] If fish would not naturally access the rivers and streams draining into the reservoir, the measure can be screened out.

Significant impacts on the morphological characteristics of rivers below dams

[B.7 and B.8] If there is evidence from relevant environmental monitoring programmes, site investigations or research programmes that the downstream river habitats are degraded for reasons other than the loss of sediment supply the impact may not be significant enough to warrant mitigation.

Significant adverse impacts on the water quality of the downstream river

[B.9 and B.10] Low dissolved oxygen; and lower than natural water temperature in summer and higher temperatures in winter may be an issue where the baseline flow regime is provided by the release of waters taken from depth upstream of large impounding structures.

If there is no evidence from available environmental monitoring data of the impoundment causing adverse impacts on dissolved oxygen levels or thermal regime in the downstream river (i.e. failures of the Good Ecological Status standards), measures B.9 and B.10 can be screened out.

Artificial Water Bodies for Water Supply purposes

A number of impoundments for Water Storage purposes are Artificial Water Bodies and have NO natural inflow or outflow being filled by pumping from a different Water Body.

The potential impacts in column B relating to upstream and downstream water bodies for ecological impact are not relevant in this situation. Water level change will be relevant.

Water quality issues in Artificial Water Bodies are likely to relate to the water body in which the abstraction takes place and appropriate links for example through Drinking Water Protection Zones.

Artificial Water Bodies for Water Supply purposes

A number of impoundments for Water Storage purposes are Artificial Water Bodies and have NO natural inflow or outflow, and are filled by pumping from a different Water Body.
The potential impacts in column B relating to upstream and downstream water bodies for ecological impact are not relevant in this situation. Water level change will be relevant.

Water quality issues in the AWB are likely to relate to the WB in which the abstraction takes place, and appropriate links e.g. through Drinking Water Protection Zones.

Measures which may not be practicable given site specific characteristics (Column C)

[C.9] Low dissolved oxygen may be an issue where water behind large impounding works becomes stratified and the main water releases are taken from depth. Where it is not practicable to release water from the surface layers of the reservoir, engineering modifications to the downstream river may sometimes be possible to help improve oxygenation (i.e. by creating an area of turbulent flow immediately downstream of the point of release).

[C.10] Where the dominant impact on the temperature regime is from water passing through generating turbines, mitigation will not be relevant for classification, as it would not be reasonably practicable to pass un-stratified water through the turbines.

Assessing whether the measure is in place and adequate (Column D)

[D.1 to D.4] Measures to mitigate significant adverse impact on the movement of one or more species of salmonid fish between habitats important in their lifecycles

These mitigation measures provide for the passage of salmonid fish only. Mitigation to provide passage for other fish species may be necessary to achieve biodiversity conservation objectives (e.g. in Natura 2000 designated sites) but are not included in the checklist for classifying ecological potential. The appropriateness of including such mitigation in classifying ecological potential will be reviewed in the next river basin management planning cycle.

Mitigation measures do not include the use of compensatory stocking programmes or the provision of alternative compensatory fish habitat (e.g. by restoring degraded fish habitat elsewhere). They do include the use of fish passes, bypass channels or capture, transfer and release programmes.

[D.1] Question: Are Structures or other mechanisms in place and managed to enable fish to access waters upstream and downstream of the impounding works (e.g. fish pass; bypass channel; etc)?

Account will be taken of whether:

(i) there is a fish pass; bypass channel or other suitable mechanism in place to enable fish to access waters upstream and downstream of the impounding works during key periods of the year for migration;

(ii) there is any evidence from relevant environmental monitoring programmes or research programmes that the pass, bypass or other mechanism is inoperative or otherwise ineffective in enabling fish access to waters upstream and downstream of the impounding works; and

(iii) where relevant, good practice standards for the design and operation of fish passes and bypass channels are met (e.g. in the Notes for Guidance on the provision of fish passes and screens for the safe passage of salmon[4] published by The Scottish Office to accompany The Salmon (Fish Passes and Screens) (Scotland) Regulations 1994), and Regulation of Fisheries under the Environment Act 1995 (or Salmon and Freshwater Fisheries Act (SAFFA) 1975 as amended by the EA 1995), WRA 1991, SAFFA 1975.

[D.2] Question: Are the volume and timing of flow releases in the downstream river sufficient to enable and, where relevant, trigger fish migration?

Account will be taken of whether:

(i) flow releases are being made, or spills occurring, during key periods of the year for migration with the intention or effect of providing for fish passage; and

(ii) there is any evidence from relevant environmental monitoring programmes or research programmes that the pattern of flow releases or spills is insufficient to enable or trigger fish migration at the relevant times.

Where there is evidence referred to in point (ii) above, the pattern of flow release should be compared with that known to be sufficient to enable or trigger fish migration at other impounding works and with the flow patterns pertaining during periods of fish migration in similar but un-impounded river systems.

[4] ISBN 07480 3105 Y (July 1995)

[D.3] Question: Is the risk of fish mortality in turbines, screens and intakes properly managed to enable downstream fish passage?

Account will be taken of whether:

(i) unless the risk of fish mortality associated with passage through intakes and turbines is expected to be low, alternate provision is made to provide safe downstream passage and screens are installed and managed in accordance with current good practice guidance (e.g. in the Notes for Guidance on the provision of fish passes and screens for the safe passage of salmon published by The Scottish Office to accompany The Salmon (Fish Passes and Screens) (Scotland) Regulations 1994); and Regulation of fisheries under the Environment Act 1995 (or Salmon and Freshwater Fisheries Act (SAFFA) 1975 as amended by the EA 1995), WRA 1991, SAFFA 1975.

(ii) there is any evidence from relevant environmental monitoring programmes or research programmes that downstream fish passage is significantly compromised.

[D.4] Question: Are fish able to access relevant feeder-streams draining into the reservoir at appropriate times for spawning and migration?

Fish access to and from rivers and streams draining into reservoirs can be restricted or even prevented as reservoir levels drop lower than they would naturally (e.g. if there is inadequate flow depth for fish movements to and from the residual water in the reservoir and the feeder streams). The establishment and maintenance of clear access channels to feeder streams at all reservoir levels can help ensure fish access to relevant streams from the residual body of water in the reservoir.

Fish access to rivers and streams draining into reservoirs may be important even where there is no fish passage at the dam.

Account will be taken of:

(i) evidence from relevant environmental monitoring programmes or research programmes that as a result of the design or management of the reservoir, fish cannot gain access to or from feeder streams important for spawning or onward migration.

[D.5] Question: Is an appropriate baseline flow regime (i.e. flows other than short-duration higher flows) being maintained in the downstream river?

The baseline flow regime refers to the basic regulated flow regime in rivers downstream of impounding works, excluding any short-duration higher flows (whether released deliberately or not) that resemble or simulate flows resulting from storm-events. The baseline regime is sometimes called the compensation flow. It includes any water passing the impounding works - including spills. Relevant research was commissioned

by UKTAG and published by SNIFFER in 2007 (WFD82) on the ecologically important components of a baseline flow regime. The criteria below are based on this research.

(i) drying of the downstream river as a result of the impounding works is avoided;

(ii) subject to point (1) below, a minimum flow volume at least equivalent to the flow volume standard defined for flows equal to Qn95 for good status in the river type concerned; and

(iii) periods of higher volume flows than those referred to in point (ii) above, which:

  (a) provide for a range of flow volumes between the minimum flow volume referred to in point (ii) and moderate flow volumes; and
  (b) reflect elements of the natural pattern and volumes of flow that would have occurred in the absence of the impounding works between moderate and low flows (e.g. flows between Qn60 and Qn95)

Point 1: Flows may be reduced below the minimum flow volume referred to in point (ii) above provided that: (a) the minimum flow volume does not drop below the volumes defined by the type-specific good status standard for flows less than Qn95; and (b) the period of time during which flows are below the minimum flow volume referred to in point (ii) is less than 18 days in any period of one year.

[D.6] Question: It may not be possible to provide baseline flow regimes, in which case has the river been adapted to meet the flow regime?

It may not be possible (e.g. without significant adverse effects on the use) to provide a baseline flow regime that avoids substantial reductions in the natural depths, widths and continuity of surface flow compared with the depths, widths and continuity that would have been present in the absence of the impounding works and associated abstractions.

Where the river has not become adapted to the baseline flow volumes (e.g. by becoming narrower; etc), the reductions in the depth, width and continuity of flow may mean that the river has limited ecological potential. In such circumstances, appropriate mitigation would include re-engineering the river (e.g. using flow deflectors) to better fit the available baseline flow regime. Such mitigation would enable the relevant checklist targets to be passed.

[D.7] Question: Is sediment management at small dams within the scheme managed in accordance with good practice?

An impoundment (dam) will normally stop movement of sediment which will lead to degradation of the downstream habitat characteristics. For all ‘old’ impoundments this may have occurred a long time ago. In current England & Wales legislation sediment cannot be re-introduced into the river and the mitigation measure will not be in place.

In England and Wales the measure will be in place if:

There is a sediment/habitat management programme in operation aimed at protecting downstream river habitats from imbalances in erosion, transport and deposition of sediment and associated armouring of the bed (e.g. by re-introducing at appropriate times, appropriate quantities of sediment consisting of suitable calibre sediment given the flow regime).

Where there is any evidence from relevant environmental monitoring programmes, site investigations or research programmes that the downstream river habitats are degraded because of the loss of sediment supply (leading to erosion or armouring of the bed) or the accumulation of sediment that cannot be transported because of the changed flow regime, this will be taken into account when deciding if the measure is in place and adequate.

In Scotland, account will be taken of whether:

(i) Sediment management at any small dams and weirs within the scheme is being undertaken in accordance with good management practice (e.g. as specified under the General Binding Rules for sediment management at small dams in Schedule 3 of the Water Environment (Controlled Activities)(Scotland) Regulations 2005 (as amended).

This measure only applies to the effects on sediments of raised lochs/lakes to the extent that the raising of lochs/lakes has changed the natural sediment regime.

[D.8] Question: Is the magnitude and frequency of short-duration higher flows sufficient to maintain river habitats downstream?

Account will be taken of:

(i) the occurrence of short-duration higher flows, coordinated with any such flows relevant under other measures, and which resemble the magnitude of flows associated with moderate storm events (i.e. flows from deliberate releases - sometimes called freshets - or from spills over or around the dam);

(ii) the extent to which the flows referred to in point (i) approach the regulated flow condition limits for good status identified by UKTAG;

(iii) where there are naturally morphologically dynamic river-types downstream, whether the flows referred to in point (i) include periodic flows every 2 to 4 years on average, which, in conjunction with appropriate sediment management, are of sufficient magnitude to enable channel-forming processes in the rivers ; and

(iv) any evidence from relevant environmental monitoring programmes or research programmes that the magnitude and frequency of short-duration higher flows is insufficient to provide for the maintenance of habitats in the downstream river.

Relevant research includes that published by SNIFFER in 2007 (WFD82).

[D.9] Question: Is the good status of dissolved oxygen levels being achieved downstream of the impounding works?

Low dissolved oxygen may be an issue where water behind large impounding works becomes stratified and the main water releases are taken from depth. Where it is not practicable to release water from the surface layers of the reservoir, engineering modifications to the downstream river may sometimes be possible to help improve oxygenation (i.e. by creating an area of turbulent flow immediately downstream of the point of release).

[D.10] Question: Is the thermal regime in waters downstream of the impounding works consistent with good status conditions?

Lower than natural water temperature in summer and higher temperatures in winter may be an issue where the baseline flow regime is provided by release of waters taken from depth behind large impounding works.

Account will be taken of any evidence that alterations to the temperature regime in the downstream river are resulting in significant adverse ecological impacts.

It may not necessarily be practicable to release water from near the surface layers of the reservoir.

[D.11] Question: Is the rate and range of any artificial drawdown appropriately managed to maintain aquatic plant and animal communities in the shore zones of impoundments with gently shelving shore zones?

Note: This measure may be ruled out in the case of certain mass-storage reservoirs (see guidance on Column E 'significant adverse effects')

Account will be taken of:

(i) the presence of a level management regime designed to mitigate the short-term impacts otherwise caused by rapid and large reductions in levels with the aim of providing a more suitable environment for the establishment of shore zone aquatic plants and animals; and

(ii) any evidence that the management regime referred to in point (i) above is ineffective in mitigating adverse impacts on shore zone aquatic plants and animals.

Ecological impacts on the shore zones of mass storage reservoirs, such as those used in some types of hydropower schemes, can be very substantial. Berms, weirs and excavated pools have been constructed in such reservoirs to help retain water in a proportion of the shallow areas of the reservoir adjacent to the shore. This is expected to protect the shore zone and increase its contribution to the ecological productivity of the reservoir. Unstable banks have also been stabilised using matting.

These techniques are in the early stages of development. In the first River Basin Management Planning cycle, they will not be included in the checklist. However, where opportunities arise to test and develop these techniques in partnership with operators of impounding works, the agencies will seek to participate in such testing.

[D.12] Question: Is the seasonal pattern of water levels during each year managed so as to enable the establishment and retention of aquatic plant and animal communities in the shore zone of the impoundment?

Note: This measure is ruled out in the case of certain mass-storage reservoirs (see guidance on Column E 'significant adverse effects')

Account will be taken of:

(i) the existence of a plan for managing the pattern of water level changes through the year with the aim of avoiding patterns of level change which would be hostile to the establishment and retention of shore zone plant and animal communities; and

(ii) any evidence that the management of the pattern of water level changes is failing to enable the establishment and retention of shore zone plant and animal communities.

Where significant adverse impact on use might apply (Column E)

Significant adverse impact on use due to potential mitigation measures will normally relate to a reduction in the yield of the service provided by the use (e.g. renewable energy in the case of impoundments used for hydropower generation).

[C.11 and C.12] Mitigation for impacts on the shore zone of reservoirs are not applicable for impoundments which are managed for the mass storage of water for use in different seasons from that in which it is collected (e.g. mass storage hydropower schemes, or drinking water supply schemes, or storage for canal supply). This includes mass storage schemes which may have other conjunctive uses, such as contributing to flood alleviation schemes. In mass storage schemes, the variation in water levels between seasons tends to be much larger than in natural lakes. This creates inhospitable conditions for the establishment and retention of the shore zone plant and animal communities that would otherwise be typical of such waters.

Mitigation involving the establishment of a more natural seasonal pattern of levels and reducing the rate of draw-down will normally have a significant adverse impact on the mass-storage use.

Where there may be a significant adverse impact on the wider environment (Column F)

Adverse impacts on the wider environment may result, for example, where the mitigation would adversely affect biodiversity or built heritage interests (e.g. listed mills and lades). The significance of these impacts will depend on their magnitude and duration and on the importance of the affected interest.

Annex III Inland Navigation

How should this Annex be used?

The purpose of this Annex is to provide specific guidance on using the checklist of mitigation measures for water bodies designated as heavily modified as a result of Inland Navigation. Guidance is provided where specific guiding principles have been identified by the sector to help the decision making process.

Where specific guidance has not been identified, the user should refer to the generic guidance.

It is anticipated that this Annex will be updated and improved in subsequent river basin management planning cycles.

This Annex should be used in conjunction with the spreadsheet entitled 'Impoundments for Water Storage and Supply'.

How is the Annex Guidance Structured?

The Annex Guidance is structured in the same way as the main document with guidance under each Column (A-F).

For comments relating to Columns C-F, reference to both the column heading (C-F) followed by the mitigation measure number is made, (specific to water body type) for example, for a guidance on under Column C for mitigation 5, this would be referenced in square brackets [C.5]

Using the Inland Navigation Checklist

The AINA (2007) Guidance, henceforth referred to as the AINA Report, provides background information on pressures and impacts (Appendix A) and mitigation measures (Appendix B) and will be a useful reference.

Measures 4, 5, 6 and 11 within the spreadsheet on the previous page are greyed out. These are measures that are included within the AINA guidance but only with relevance to 'new modifications'. As such, these measures are not considered in the classification of GEP.

In addition, the spreadsheet contains a number of measures are repeated (and identified in italics). These are measures that are relevant to more than one impact, for example, Measure 9 (awareness raising of invasive species) is relevant to users of marinas and similar navigation infrastructure, as well as general boat movement. It may not be necessary to repeat the decision making for the measure if both pressures apply.

ANNEX III: INLAND NAVIGATION

Sector: **Inland Navigation**

Waterbody Information:

Waterbody Name			Easting	Northing
Waterbody ID		Downstream NGR Waterbody		
Waterbody Type		Upstream NGR Waterbody		

List the pressures identifed within the HMWB/AWB designation for this waterbody	
Record other water uses appearing to cause signficant pressure not identified within the HMWB/AWB designation	

	A		B			C	D	E	F	G	H	I
Pressure (physical modification)	**Is the pressure present? (Y/N) If Yes, proceed to column B.**		**Is there a significant adverse ecological impact or, in the absence of any mitigation already in place, could there be a significant adverse impact? (Y/N) If yes, proceed to column C, if no document and proceed to Column G.**	**Mitigation Measures**	**No.**	**Is the measure practicable given the characteristics of the water body? (Yes/No) If yes, proceed to Column D. If no, document and proceed to column G.**	**Is the mitigation measure in place and adequate? (Yes/No) If No, proceed to Column E. If Yes document the mitigation measure and proceed to Column G.**	**Can the measure be implemented without having a significant adverse impact on use? (Yes/No) If yes, proceed to column F, if no document and proceed to Column G.**	**Can the measure be implemented without having a significant adverse impact on the wider environment? (Yes/No) If yes, proceed to Column G, If no document and proceed to Column G.**	**Document: x : For measures not in place (proceed to Column H) 9: For those already in place and adequate - : For those screened out**	**Will the mitigation measure provide more than a slight ecological benefit when considered alone or in combination with other measures? If yes, proceed to Column I; if no, document**	**Document any reasons which could affect the inclusion of the measure in the RBMP (e.g. prioritisation in combination with other measures, disproportionate cost, other reasons why an extended deadline or less stringent target might be justified)**
Hard bank protection E.g. Steel piling, vertical walls. Includes hard bank protection in a state of disrepair.		Loss of riparian zone / marginal habitat / loss of connectivity / loss of sediment input / loss of wave energy absorption		Removal of hard bank reinforcement / revetment, or replacement with soft engineering solution	**1***							
				Preserve and where possible enhance ecological value of marginal aquatic habitat, banks and riparian zone	**2**							
				Preserve and, where possible, restore historic aquatic habitats	**3***							
Measures 4, 5 and 6 are referred to in the AINA report and are for NEW MODIFICATIONS ONLY					**4-6**							
Locks and weirs All types of locks, including locks in a state of disrepair, and weirs associated with locks *(Also consider impacts associated with hard bank protection and sediment management)*		Loss of sediment continuity - build up of sediment upstream, reduced bedload downstream		Operational and structural changes to locks and weirs	**7***							
		Loss of biological continuity - interference with fish population movements										
				Install fish passes	**8***							
Other navigation structures Maintenance areas / docks / dry docks / marinas / slipways / rowing steps *(Also consider impacts associated with*		Invasive species transfer		Awareness raising / information boards (invasive species)	**9**							
		Source of fine sediment / deposition of fine sediment		Awareness raising / information boards (boat wash / sources of fine sediment)	**10**							
Measure 11 is referred to in the AINA report and is for NEW MODIFICATIONS ONLY					**11**							
Realignment / Re-profiling / Re-grading for navigation		Loss of morphological diversity and habitat		Increase in-channel morphological diversity	**12***							
Sediment management		Direct loss of / impact to aquatic habitats / hydromorphology		Sediment management strategies (develop and revise)	**13**							
		Transfer of fine sediment downstream										
		Bankside erosion and impacts to riparian habitats										
		Source of fine sediment (disposal of dredgings on banks)										
De-watering (for maintenance of navigable channel)		Loss / impact to aquatic flora and fauna		Phased de-watering and other techniques	**14**							
Vegetation control		Physical disturbance of bed and or bank-increased sediment input; sediment mobilisation and loss of marginal / riparian vegetation		Selective vegetation control regime	**15**							
				Appropriate vegetation control technique	**16**							
				Appropriate timing	**17**							
		Transfer and establishment of alien invasive species		Appropriate techniques (invasive species)	**18**							
Boat Movement Surface water disturbance and turbulence created by passage of hull *(Also consider impacts associated with on-line moorings and sediment management)*		Bank Erosion / loss of marginal, riparian vegetation (boat wash)		Encourage reduction of boat wash impacts through traffic management in sensitive areas	**19**							
				Encourage use of environmentally friendly vessel design	**20**							
				Bank rehabilitation	**21**							
				Awareness raising / information boards (boat wash / sources of fine sediment)	***10***							
		Bed scour / Sediment mobilisation / macrophyte disturbance (propeller action)		Lateral zoning to concentrate boats within a central track	**22***							
				Encourage use of environmentally friendly vessel design	***20***							
		Transfer and establishment of alien invasive species		*Awareness raising / information boards (invasive species)*	***9***							

Hydromorphological assessment for classification	

* Measures that are not applicable to AWBs (i.e. canals). These measures should be screened out at Column C when assessing an AWB
Italics denote measures that are applicable to more than one impact.It may not be necessary to re-assess the measure, please see Guidance.

Identifying pressures (Column A)

Please see generic guidance and the AINA report.

Identifying where there is no significant adverse ecological impact (Column B)

The impacts identified within the spreadsheet are related to those hydromorphological quality elements listed within the Water Framework Directive itself (Annex V). In order to determine whether an impact is significant within specific water bodies, it may help to refer back to those quality elements. These are as follows:

- Hydrological regime
  - Quantity and dynamics of water flow
  - Connection to ground water bodies
- River continuity
- Morphological conditions
  - Width and depth variation
  - Structure and substrate of the river bed
  - Structure of the riparian zone

The hydromorphological quality elements listed above are considered to (in part) support the biological quality elements of the Water Framework Directive. For reference the biological quality elements are as follows:

- Composition and abundance of aquatic flora
  - Phytoplankton
  - Macrophytes and phytobenthos
- Composition and abundance of benthic invertebrate fauna
- Composition, abundance and age structure of fish fauna

[B.1] This measure is not considered applicable to canals. It is considered that replacement of hard bank protection will only occur at the end of asset life, i.e. it would be considered as a new modification that would be required to meet the objective of no deterioration.

[B.2] Preserve and enhance are two separate measures. Preserve applies to banks without hard bank protection, and means where erosion protection is needed and soft bank protection techniques should be used where possible. Enhance applies to banks with hard bank protection, and means creating habitat in front of the bank.

[B.1, 2 & 3] Hard bank protection surfaces can provide a habitat that is otherwise missing from most waterways because of the absence of rocky substrate. Some hard bank protection within a water body may therefore of value in creating habitat diversity, i.e. the presence of hard bank protection may be supporting valuable flora and fauna and its removal may result in a greater impact on diversity.

[B.7- *loss of sediment continuity*] Canals do not suffer sediment continuity related issues, such as erosion downstream of impounding structures or lack of dynamic flow through the system.

[B.7 & B.8] Artificial water bodies do not represent natural routes for migration. As such, there is no requirement to encourage diadramous species (such as salmon and eels) into artificial canals.

[B.10] The quantity of sediment inputs from navigation structures such as marinas, docks, maintenance areas, etc may be minimal compared with the amount of sediment already in suspension in a canal.

[B.13 – *transfer of fine sediment*] For canals this is only considered an issue where hydrodynamic dredging techniques are used.

[B.13 – *transfer of fine sediment*] Where dredgings are disposed of to land, sediment transferred downstream may typically be due to incidental disturbance. Impacts on canals are very limited due to:

- low flow rate that restricts the spread of the sediment plume, and
- canals are typically turbid due to effects of boat traffic, especially at high traffic levels.

[B.18] Impact only occurs when propagules are transferred to other parts of the water body, or to another water body, either in the water flow, or via plant and equipment. Taking no action to control vegetation can also result in a pressure, particularly with floating leaved species, because large growths can result in fragments breaking away and moving downstream.

[B.19] Where macrophytes are not controlled by other factors such as nutrients, an increase in boat traffic from zero to low levels can be ecologically beneficial by controlling excessive growth of dominant species.

Measures which may not be practicable given site specific characteristics (Column C)

[C.1] This pressure is not considered as a legacy issue to **canals**, given that measures can only realistically be implemented at the end of the existing asset life. As such, it would be considered as 'new modification' and not taken forward for the determination of measures to achieve GEP.

[C.2] Enhance applies to banks with existing hard bank protection, and means creating / enhancing it as a habitat: In many cases heavy boat traffic, close to the banks, will prevent habitat being established due to the eroding effects of wash and return currents, meaning that this measure, given the site specific circumstances, cannot be practicably implemented. Preserve applies to banks without hard bank protection, and means where erosion protection is needed, soft bank protection techniques should be used where possible.

[C.3] As canals are new cuts, there are no historic re-connections to natural habitats to be made. However, there may be scope to restore and reconnect old branches, docks and winding holes in some canal systems.

[C.7 & C.8] Not applicable to canals (AWBs). Artificial nature of canals means they are not a potential migratory route for fish.

[C.11 & 12] Retaining marginal aquatic habitats and increasing in-channel morphological diversity may not be applicable to canals (AWBs) where they are too narrow and it would affect navigation.

[C.22] Lateral zoning may not be applicable to canals (AWBs) where they are too narrow and it would affect navigation.

Assessing whether the measure is in place and adequate (Column D)

[D.2] Soft bank protection techniques will usually be used where there are no engineering or user constraints. Guidance available from various sources (see AINA report), incl. "Waterways Bank Protection: A Guide to Erosion Assessment and Management", EA R&D Publication No 11, 1999.

[D.13 - *loss of aquatic habitats*] British Waterways Environmental Code of Practice (ECP) appraisal process requires identification of valuable habitats and species and retention where possible. BW standard dredging profile includes a 1m wide shallow margin on off side where practicable. Other navigation authorities may have similar procedures in place.

[D.13 – *transfer of fine sediment*] There is a BW/EA Memorandum of Understanding on hydrodynamic dredging operations that place a requirement on BW to consult with the EA, and, for those techniques that are not regulated, for BW to seek agreement with the EA on how to carry them out following an environmental appraisal. Other navigation authorities may have similar procedures in place.

[D.13 – *bankside erosion and impacts to riparian habitats*] Offloading points, where dredgings are transferred from floating plant to land, are selected following environmental appraisal for British Waterway's managed waterways. BW standard method is to protect banks during operation and to reinstate afterwards. Other navigation authorities may have similar procedures in place.

[D.13 – *source of fine sediment*] Where dredgings are used to reinstate eroded banks, British Waterways standard practice is to protect the new bank edge with soft bank protection methods, or hard bank protection, where necessary, for engineering or user reasons. BW follow the Code of Good Agricultural Practice for the Protection of Water (MAFF, 1991). Other navigation authorities may have similar procedures in place.

[D.14] British Waterways ECP appraisal process requires valuable habitats and species that might be affected to be identified and mitigation to be applied where possible. This usually includes: minimising the length to be dewatered; retaining as much water as possible; refilling as soon as possible; fish rescue and relocation; discharging water to adjacent canal length where possible; and avoid disturbing and transferring sediment. An ecological assessment of the length is also made for protected species and

measures are taken to protect them where necessary and feasible, e.g. temporary translocation. Other navigation authorities may have similar procedures in place.

[D.15, 16, 17 & 18] British Waterways ECP appraisal process considers the adequacy of measures such as selective vegetation control, timing, and techniques. "*Aquatic Weed Control*" produced by the Centre for Aquatic Plant Management, is also used by BW as part of their appraisal. Other navigation authorities may have similar procedures in place.

[D.19] Many navigation authorities already apply speed restrictions, e.g. British Waterways has a speed limit of 4 mph on the majority of their waterways (except a few larger ones used for freight where it varies from 6 to 10 mph). BW and EA also advocate a reduction of boat wash impacts through the BW/EA "Boaters Handbook". All navigation authorities have access to The Green Blue's "*How to.... Guide to Inland Waters*", which also advocates this.

[D.19] British Waterways ECP appraisal process, and externally through the land use planning process requires careful consideration of the impacts of canal restorations, new marinas, and other new boater attractions. Other navigation authorities may have similar procedures in place.

[D.20] The Green Blue's "*How to.... Guide to Inland Waters*" encourages use of hull designs that reduce wash.

Where significant adverse impact on use might apply (Column E)

[E.2] If enhancing or preserving the marginal vegetation results in a canal becoming too narrowed for boats to navigate safely, or prevents boats from mooring hard up against the bank (in areas identified for mooring) then the measure may be deemed to have a significant impact on use. Marginal vegetation, i.e. not having hard bank protection, may also have an impact where the structural strength of the bank is paramount, e.g. where supporting a towpath, where bank erosion could cause catastrophic failure, e.g. at embankments, or where safety is important, e.g. at locks or lock approaches.

[E.13] Retaining marginal vegetation during sediment management operations may affect navigation through a reduction in areas suitable for temporary mooring. British Waterways has width and depth standards for each waterway and these are dictated by use, but sometimes it is possible to leave a shallow margin and reed fringe while still complying with these standards, and also without interfering with on line moorings.

[E.15] The centre channel, edges at moorings, winding holes, and other parts of the canal used by boaters need to be kept clear for navigation reasons.

[E.17] Timing is dictated by the plant species being controlled and by the need to keep the channel open for navigation, especially during the main boating season April-Oct inclusive. This usually means control during spring and summer.

[E.19] Many waterways already enforce speed restrictions, e.g. British Waterways has a speed limit of 4 mph on the majority of their waterways (except a few larger ones used for freight where it varies from 6 to 10 mph). A slower speed limit than this would have a

significant adverse effect on use, i.e. navigation. Limiting traffic levels would also have a significant effect on use, i.e. navigation.

[E.19] BW and some other navigation authorities have a statutory duty to make their waterways available to navigation. Any measures that would affect this would be considered to have a significant adverse impact ton use.

Where there may be a significant adverse impact on the wider environment (Column F)

[F.1] Hard bank protection may be needed to maintain use or protect wider environment (e.g. water sealing, protect embankments and other structures, widen towpath, enable towpath to take loads, restore heritage walling, etc).

Annex IV Flood Risk Management

How should this Annex be used?

The purpose of this Annex is to provide specific guidance on using the checklist of mitigation measures for water bodies designated as heavily modified as a result of Flood Risk Management. Two separate checklists of measures have been provided for FRM for rivers and TRaC water bodies. The information contained within this Annex covers both, distinguishing where necessary, and the information should be read in conjunction with the forms.

Guidance is provided where specific guiding principles have been identified by the sector to help the decision making process. Where specific guidance has not been identified the user should refer to the generic guidance.

It is anticipated that this Annex will be updated and improved in subsequent river basin management planning cycles.

How is the Annex Guidance Structured?

The Annex Guidance is structured in the same way as the main document with guidance under each column (A-F).

Filling in the forms

During trialling of the process, it was found that decisions on the answers to the questions within the forms must rely on expert judgement. Experts are also needed to temporarily drill down into the detailed knowledge of a water body to glean relevant information so that assumptions can be made and applied strategically for the entire water body. The comments that are likely to arise during the classification process are likely to be important to these should be recorded into the form at the meeting.

In order to maximise the effectiveness of the expert group meeting, it is suggested that the representatives attending should be asked to bring with them the following:

- Information on physical modification (function, maintenance of structures, residual life etc from the National Flood and Coastal Defence Database where possible).
- Information on ongoing maintenance regimes (likely to be anecdotal derived from locals).
- Information on any existing Flood and Coastal Defence Database mitigation measures and the impacts they are intended to mitigate.

ANNEX IV: FLOOD RISK MANAGEMENT

Sector: **FRM Transitional and Coastal Waters**

Waterbody Information:

Waterbody Name			Easting	Northing
Waterbody ID		NGR Waterbody Boundary		
Waterbody Type		NGR Waterbody Boundary		

List the pressures identifed within the HMWB/AWB designation for this waterbody	
Record other water uses appearing to cause signficant pressure not identified within the HMWB/AWB designation	

		A		B			C	D	E	F	G	H	I
Pressure (physical modification)	**Sub-pressure**	**Is the pressure present? (Y/N) If Yes, proceed to column B.**	**Potential Impacts**	**Is there a significant adverse ecological impact or, in the absence of any mitigation already in place, could there be a significant adverse impact? (Y/N) If yes, proceed to column C, if no document and proceed to Column G.**	**Mitigation Measures**	**No.**	**Is the measure practicable given the characteristics of the water body? (Yes/No) If yes, proceed to Column D. If no, document and proceed to column G.**	**Is the mitigation measure in place and adequate? (Yes/No) If No, proceed to Column E. If Yes document the mitigation measure and proceed to Column G.**	**Can the measure be implemented without having a significant adverse impact on use? (Yes/No) If yes, proceed to column F, if no document and proceed to Column G.**	**Can the measure be implemented without having a significant adverse impact on the wider environment? (Yes/No) If yes, proceed to Column G, If no document and proceed to Column G.**	**Document: x : For measures not in place (proceed to Column H) 9: For those already in place and adequate - : For those screened out**	**Will the mitigation measure provide more than a slight ecological benefit when considered alone or in combination with other measures? If yes, proceed to Column I; if no, document**	**Document any reasons which could affect the inclusion of the measure in the RBMP (e.g. prioritisation in combination with other measures, disproportionate cost, other reasons why an extended deadline or less stringent target might be justified)**
Shoreline reinforcement / elevation	Bank reinforcement		Coastal squeeze; Disruption of tidal flow and channel interaction; Disruption / alteration of estuarine process dynamics; Modification of sediment dynamics; Disruption of natural habitats; Loss of faunal nursery, refuge and feeding areas			1							
					Modify existing structures	2							
					Replacement with soft engineering solution	3							
					Bank reprofiling	4							
					Managed realignment of flood defence	5							
					Restore / create / enhance aquatic and marginal habitats	6							
					Indirect / offsite mitigation (offsetting measures)	7							
Operations and maintenance	Channel dredging		Alteration of bathymetry; Disruption / alteration of natural tidal and sediment dynamics; Destruction and alteration of benthic habitats; Mobilisation of contaminants; Increased turbidity (periodically)		Sediment management strategies (develop and/or revise)	8							
					Indirect / offsite mitigation (offsetting measures)	9							
	Deposition of material		Smothering of existing floral and faunal and habitats; Alteration of estuarine processes; Alteration of natural sediment dynamics; Alteration of bathymetry		Material emplacement strategies (develop and/or revise)	10							
Channel alteration	Tidal river alteration e.g. channelisation / realignment / straightening		Disruption of tidal flow and interaction; Alteration of estuarine processes; Alteration of natural sediment dynamics; Alteration of bathymetry; Loss of morphological diversity and habitat		Restore / create / enhance aquatic and marginal habitats	11							
					Increase in-channel morphological diversity	12							
					Indirect / offsite mitigation (offsetting measures)	13							
Impoundment	Locks, sluices and tidal barrages		Alteration of bathymetry; Disruption of tidal flow and interaction; Alteration of natural sediment dynamics - loss of continuity; Destruction and alteration of benthic habitats; Mobilisation of contaminants; Increased turbidity; Loss of faunal nursery, refuge and feeding areas; Disruption of habitat connectivity/continuity - interference with fish population movements		Removal of structure	14							
					Operational and structural changes to locks, sluices and tidal barrages	15							
					Install fish passes	16							
					Indirect / offsite mitigation (offsetting measures)	17							
Manipulation of sediment transport	Installation of beach control structures		Disruption of tidal flow and interaction; Alteration of estuarine processes; Alteration of natural sediment dynamics; Alteration of bathymetry; Direct / indirect habitat loss		Removal of structure	18							
					Modify structure design	19							
					Restore / create / enhance aquatic and marginal habitats	20							
					Indirect / offsite mitigation (offsetting measures)	21							

Hydromorphological assessment for classification	

ANNEX IV: FLOOD RISK MANAGEMENT

Sector: **FRM River and Drainage Watercourses**

Waterbody Information:

			Easting	Northing
Waterbody Name				
Waterbody ID		Downstream NGR Waterbody		
Waterbody Type		Upstream NGR Waterbody		

List the pressures identifed within the HMWB/AWB designation for this waterbody	
Record other water uses appearing to cause signficant pressure not identified within the HMWB/AWB designation	

		A		B		No.	C	D	E	F	G	H	I
Pressure (physical modification)	**Sub-pressure**	**Is the pressure present? (Y/N) If Yes, proceed to column B.**	**Potential Impacts**	**Is there a significant adverse ecological impact or, in the absence of any mitigation already in place, could there be a significant adverse impact? (Y/N) If yes, proceed to column C, if no document and proceed to Column G.**	**Mitigation Measures**		**Is the measure practicable given the characteristics of the water body? (Yes/No) If yes, proceed to Column D. If no, document and proceed to column G.**	**Is the mitigation measure in place and adequate? (Yes/No) If No, proceed to Column E. If Yes document the mitigation measure and proceed to Column G.**	**Can the measure be implemented without having a significant adverse impact on use? (Yes/No) If yes, proceed to column F, if no document and proceed to Column G.**	**Can the measure be implemented without having a significant adverse impact on the wider environment? (Yes/No) If yes, proceed to Column G, If no document and proceed to Column G.**	**Document: x : For measures not in place (proceed to Column H) 9: For those already in place and adequate - : For those screened out**	**Will the mitigation measure provide more than a slight ecological benefit when considered alone or in combination with other measures? If yes, proceed to Column I; if no, document**	**Document any reasons which could affect the inclusion of the measure in the RBMP (e.g. prioritisation in combination with other measures, disproportionate cost, other reasons why an extended deadline or less stringent target might be justified)**
Bank and bed reinforcement and in-channel structures	Hard protection e.g. Steel piling, vertical walls and gabion baskets. Includes hard bank protection in a state of disrepair.		Loss of riparian zone / marginal habitat / loss of lateral connectivity / loss of sediment input		Removal of hard bank reinforcement / revetment, or replacement with soft engineering solution	1							
					Protect and enhance ecological value of marginal aquatic habitat, banks and riparian zone	2							
					Protect and restore historic aquatic habitats	3							
			Loss of sediment continuity (lateral) - build up of sediment in the channel		Removal of hard bank reinforcement / revetment, or replacement with soft engineering solution	4							
					Protect and enhance ecological value of marginal aquatic habitat, banks and riparian zone	5							
					Protect and restore historic aquatic habitats	6							
	Dams, sluices, weirs and gravel traps		Loss of biological continuity - interference with fish population movements		Operational and structural changes to sluices and weirs	7							
					Install fish passes	8							
			Loss of sediment continuity (longitudinal) - build up of sediment upstream, reduced bedload downstream		Removal of structure	9							
Channel alteration	Realignment / re-profiling / regrading		Loss of morphological diversity and habitat		Retain marginal aquatic and riparian habitats	10							
					Increase in-channel morphological diversity, e.g. install instream features; 2 stage channels	11							
	Culverts		Loss of morphological diversity and habitat		Re-opening existing culverts	12							
					Alteration of channel bed	13							
			Continuity		Re-opening existing culverts	14							
					Alteration of channel bed	15							
Floodplain modification	Flood banks and flood walls		Loss of riparian zone / marginal habitat / loss of lateral connectivity / loss of sediment input		Flood bunds (earth banks)	16							
					Set-back embankments (a type of managed retreat)	17							
					Improve floodplain connectivity	18							
Operations and maintenance	Sediment management (including dredging)		Direct loss of / impact on aquatic habitats / hydromorphology		Sediment management strategies (develop and revise) which could include a) substrate reinstatement, b) sediment traps, c) allow natural recovery minimising maintenance, d) riffle construction, e) reduce all bar necessary management in flood risk areas	19							
			Transfer of fine sediment downstream										
			Bankside erosion and impacts on riparian habitats										
			Source of fine sediment (disposal of dredgings on banks)										
	Removal/clearance of urban trash and woody debris		Loss of aquatic habitats		Appropriate channel maintenance strategies and techniques e.g. minimise disturbance to channel bed and margins	20							
			Transfer of fine sediment downstream		Appropriate channel maintenance strategies and techniques e.g. remove woody debris only upstream of, or within, areas of urban flood risk	21							
	Vegetation control		Physical disturbance of bed and or bank - increased sediment input; sediment mobilisation and loss of marginal / riparian vegetation		Appropriate vegetation control regime e.g. a) minimise disturbance to channel bed and margins, b) selective vegetation management for example only cutting from one side of the channel, c) providing/reducing shade, d) seasonal maintenance	22							
			Transfer and establishment of alien invasive species		Appropriate techniques to prevent transfer of invasive species e.g. appropriate training of operational staff	23							
	Pipes, inlets, outlets and off-takes		Hydromorphological alterations of water and sediment inputs through artificial means		Appropriate techniques to align and attenuate flow to limit detrimental effects of these features	24							

Hydromorphological assessment for classification	

Identifying pressures (Column A)

It is sometimes the case that historic physical alteration of the channel has been undertaken for reasons other than Flood Risk Management, for example, bank and bed reinforcement, channel alteration and floodplain modifications are common in industrial catchments. Although these assets are not part of formal FRM schemes and are not routinely maintained by the regulatory authority, in some cases flood modelling may show that the structures provide a flood risk benefit and it is within the jurisdiction of the regulatory authority to provide reactive maintenance if for example the wall or weir fails. These are known as 'defacto structures' and should be included as pressures.

Identifying where there is no significant adverse ecological impact (Column B)

The impacts identified within the spreadsheet are related to those hydromorphological quality elements listed within the Water Framework Directive itself (Annex V). In order to determine whether an impact is significant within specific water bodies, it may help to refer back to those quality elements. These are as follows:

- Hydrological regime
  - Quantity and dynamics of water flow
  - Connection to ground water bodies
- Morphological conditions
  - Depth and width variation
  - Quantity, structure and substrate of the bed
  - Structure of the riparian zone or inter-tidal zone
- River continuity
- Tidal regime
  - Freshwater flow
  - Wave exposure

The hydromorphological quality elements listed above are considered to (in part) support the biological quality elements of the Water Framework Directive. For reference the biological quality elements are as follows:

- Composition and abundance of phytoplankton
- Composition and abundance of other aquatic flora
  - Macrophytes and phytobenthos
  - Macroalgae
  - Angiosperms
- Composition and abundance of benthic invertebrate fauna
- Composition, abundance and age structure of fish fauna

Measures which may not be practicable given site specific characteristics (Column C)

As water bodies in many cases are large (for example encompassing entire catchments), it may be the case that certain mitigation measures may be practicable in one location (for example where a policy may be to increase flood risk through removing flood defence infrastructure it may be possible to reconnect river and floodplain) but not practicable elsewhere (for example, where defences are required to protect urban areas). Where it is practicable to implement measures in certain locations the measure should be retained. Lack of space to restore may change into the future thus any potential for regeneration, identified in Local Development Frameworks or other strategic plans, particularly in urban areas, might be flagged up for future consideration in revision to RBMP plans.

Assessing whether the measure is in place and adequate (Column D)

Where a measure is already 'in place and adequate', this should be documented and the delivery mechanism for the measure should be explained.

The measure may be considered to be adequately implemented if, for example:-

- The measure is being undertaken in accordance with the regulators policy and or process guidance.
- The measure is being delivered through established good/best practice.
- The measure has been implemented in all locations where practicable.

For spatially variable measures, where the measure could be further applied within the water body towards improving hydromorphological quality elements then the measure is **not** fully in place or adequate as the ecological potential has not been achieved.

Where the measure has been achieved through suspension of an existing practice (such as maintenance dredging) for reasons other than ecological enhancement (for example, to reduce costs) but ecological benefit has been achieved, note should be made of this as an indirect measure. Although the maintenance activity may not have occurred for sometime, it may not have formally ceased and as such could recommence. Works should follow the regulators policy (where available) on gravel removal, however, by noting this as a mitigation measure, any recommencement of works would need to demonstrate the benefit to flood risk management before being undertaken.

Where significant adverse impact on use might apply (Column E)

Significant adverse impact on use would be determined in the case of Flood Risk Management where:

- Flood defence infrastructure or activity is still required and active and undertaking the measure would either compromise the function and integrity of the asset or activity and/or reduce the residual life of the asset.
- Any change in the infrastructure or activity would result in a change in flood risk at upstream, downstream or alongshore which would be against the policy set out within large scale plans or policies.

Where there may be a significant adverse impact on the wider environment (Column F)

See generic guidance.